Field Evaluation
AQMesh Monitor (v.4.0)

South Coast AQMD

AQ-SPEC
Air Quality Sensor Performance Evaluation Center

Background

- From 06/26/2015 to 09/25/2015 three AQMesh (Version 4.0) gaseous monitors (PODs) were deployed in Rubidoux and run side-by-side SCAQMD Federal Reference Method (FRM) instruments measuring the same pollutants

- AQMesh (*3 units tested*):
  - Electrochemical sensors (non-FEM)
  - Each unit measures: CO, NO, NO_2, O_3, Temp, RH
  - Unit cost: ~$10,000
  - Time resolution: 1- or 15-min
  - Units IDs: POD 1, POD 2, POD 3

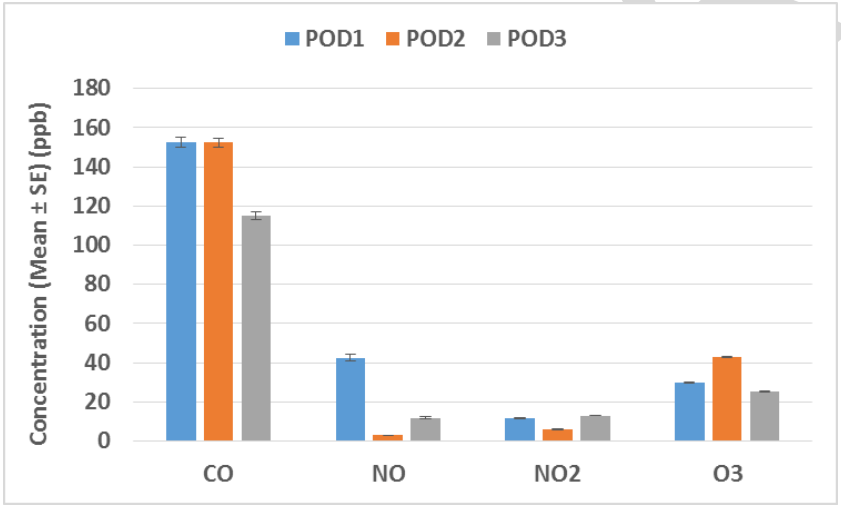
- SCAQMD FRM instruments:
  - CO instrument; cost: ~$10,000
    - Time resolution: 1-min
  - NO_X instrument; cost: ~$11,000
    - Time resolution: 1-min
  - O_3 instrument; cost: ~$13,000
    - Time resolution; 1-min
  - Meteorological station (wind speed, wind direction temperature, relative humidity, and pressure); cost: ~$5,000
    - Time resolution: 1-min

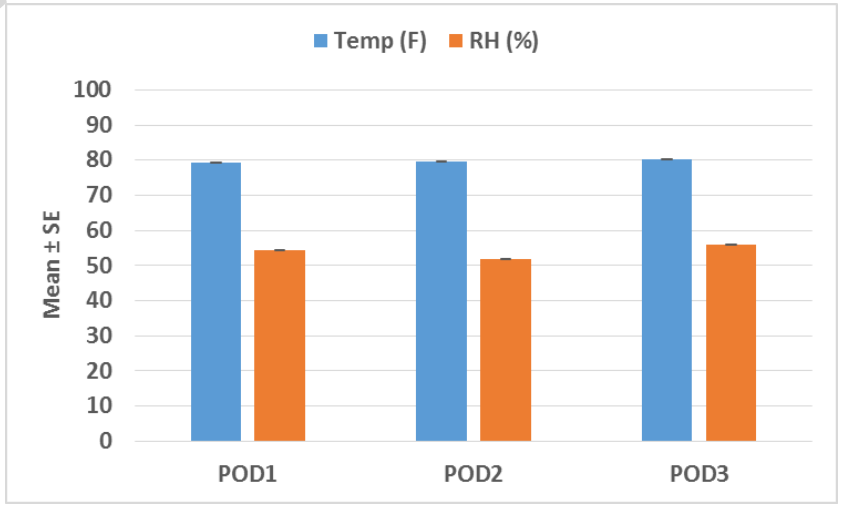
Data validation & recovery

- Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, and invalid data-points were eliminated from the data-set)
- Data recovery for the three PODs was high (i.e. 93% for POD1, 100% for POD2 and 90% for POD3)

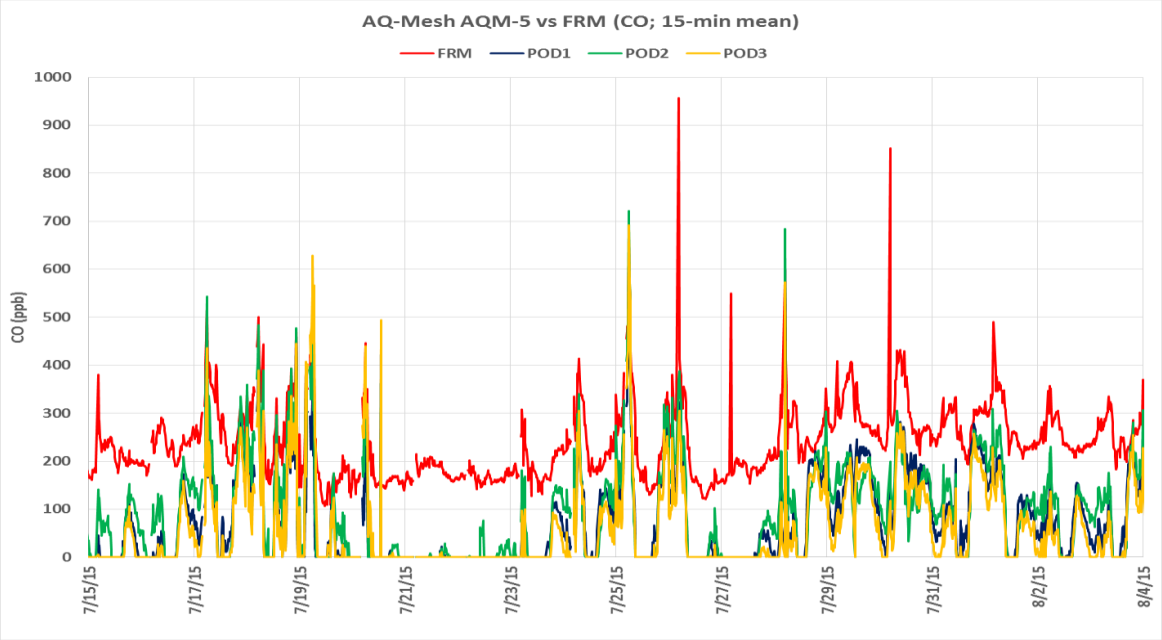
AQMesh; intra-model variability

- Substantial measurement variations were observed between the three AQMesh units for all measured pollutants. PODs showed very low variations for T and RH

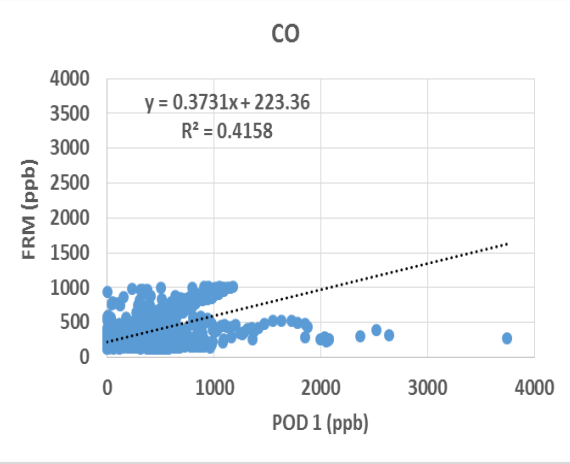


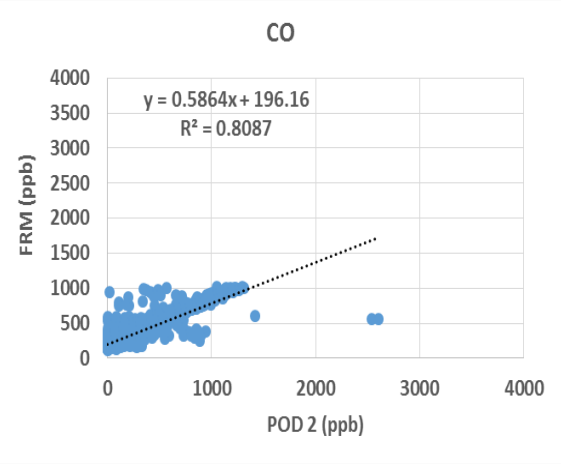


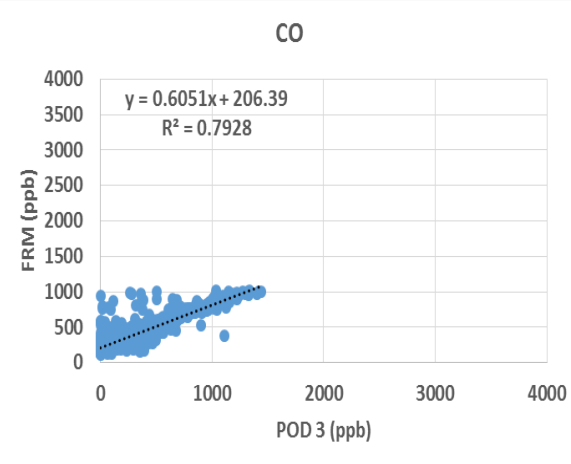
AQMesh vs FRM (CO; 15-min ave)



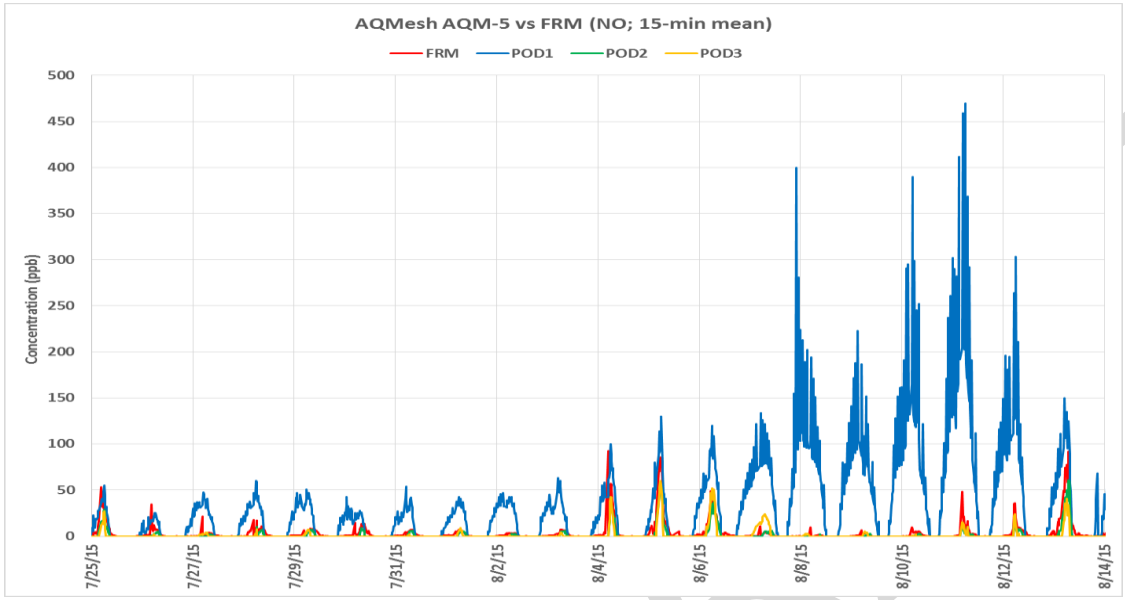
- AQMesh CO measurements show a fair-to-good correlation with the corresponding FRM data ($0.42<R^2<0.80$)
- The AQMesh PODs seem to underestimate the CO concentration levels measured by the FRM instrument



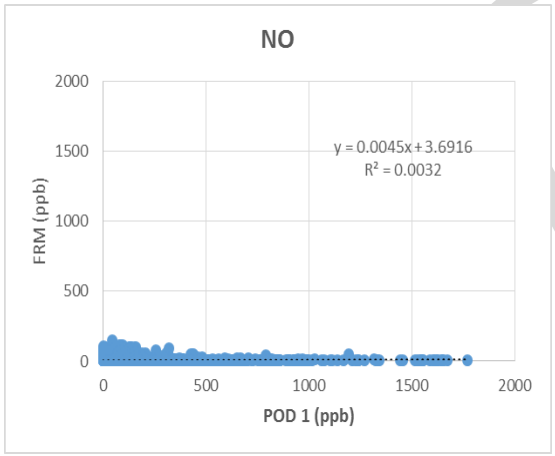


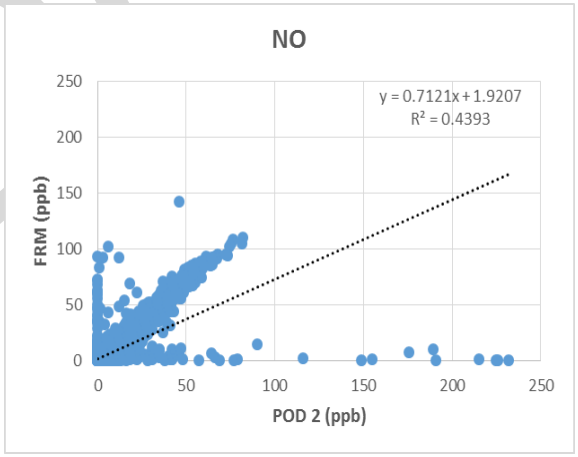


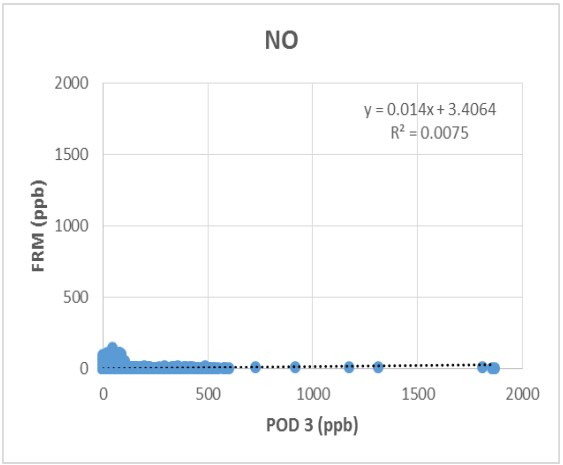
AQMesh vs FRM (NO; 15-min ave)



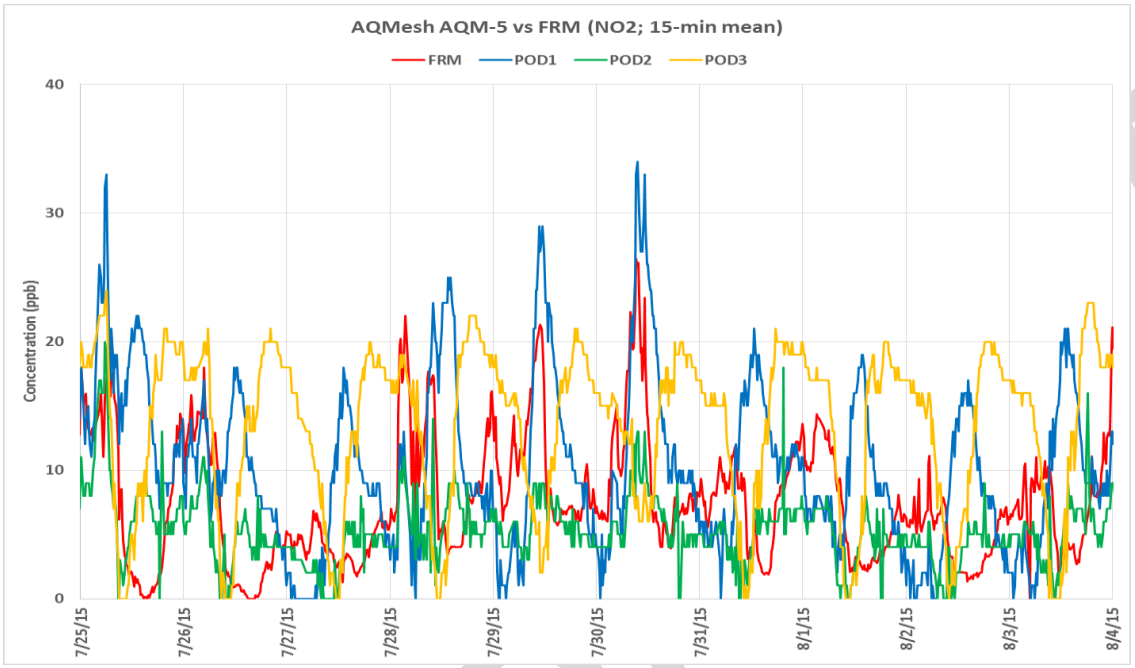
- AQMesh NO measurements from PODs 1 and 3 do not correlate well with the corresponding FRM data (R^2~0.0).
- AQMesh NO measurements from POD 2 show a fair correlation with the corresponding FRM (R^2=0.44).
- POD 1 largely overestimates FRM NO measurements



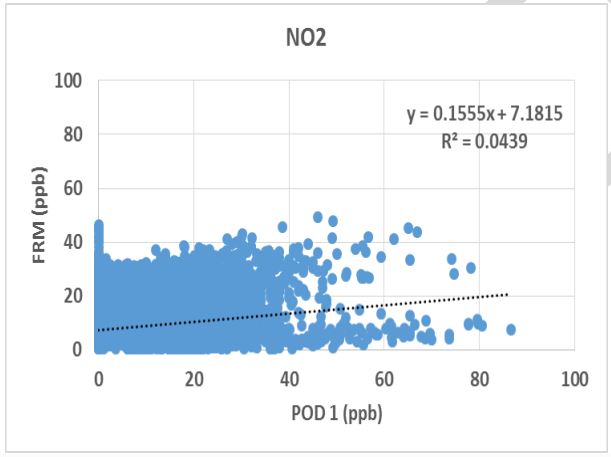


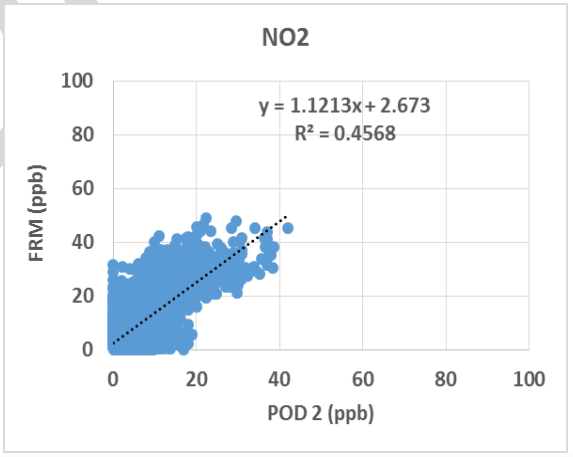


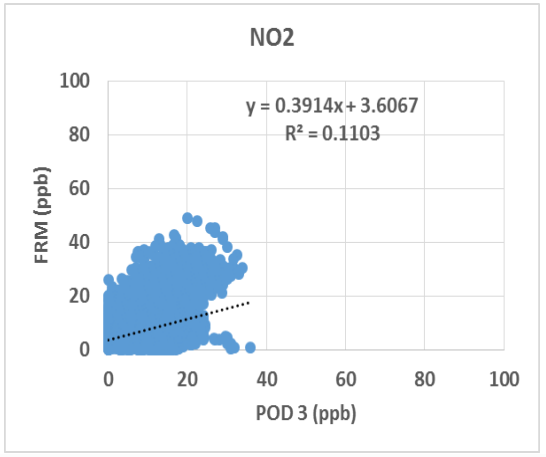
AQMesh vs FRM (NO2; 15-min ave)



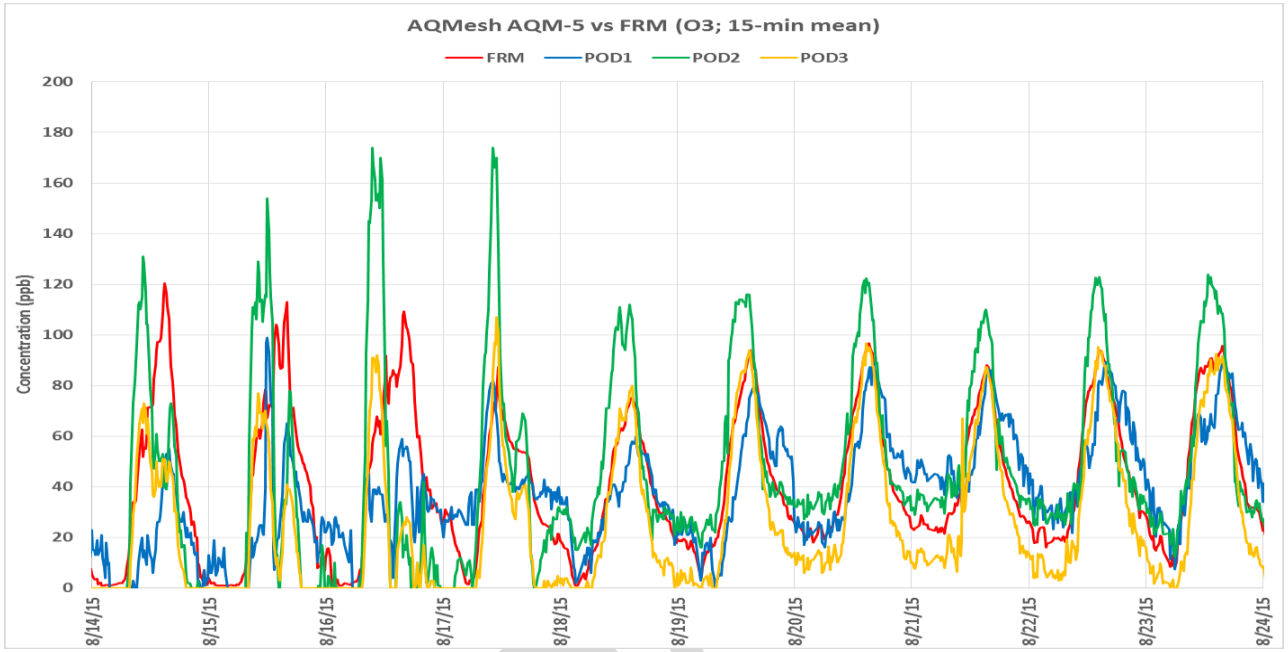
- AQMesh NO_2 measurements from PODs 1, 2 and 3 do not seem to track the typical NO2 diurnal variations recorded by the FRM instrument.
- PODs 1 and 3 measurements correlate poorly ($0.0<R^2<0.11$) with the corresponding FRM data. However, POD 2 shows a fair correlation (R2=0.46) with the corresponding FRM NO2 measurements



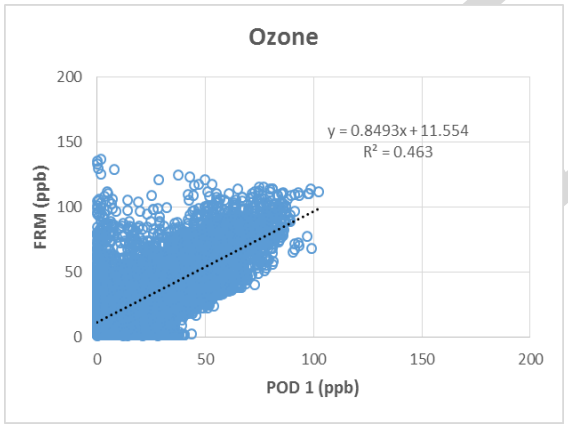


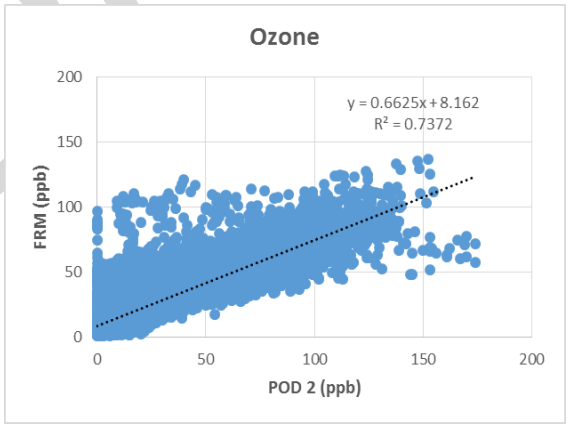


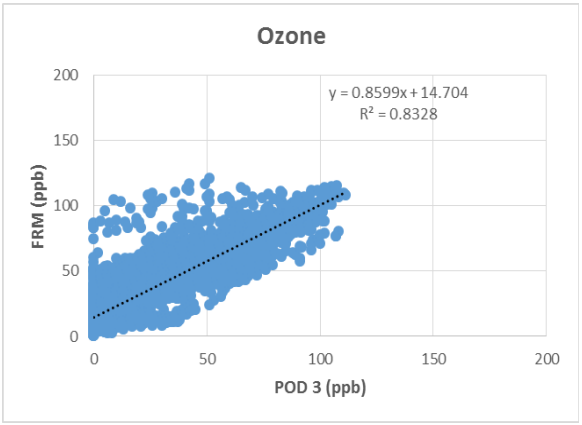
AQMesh vs FRM (O3; 15-min ave)



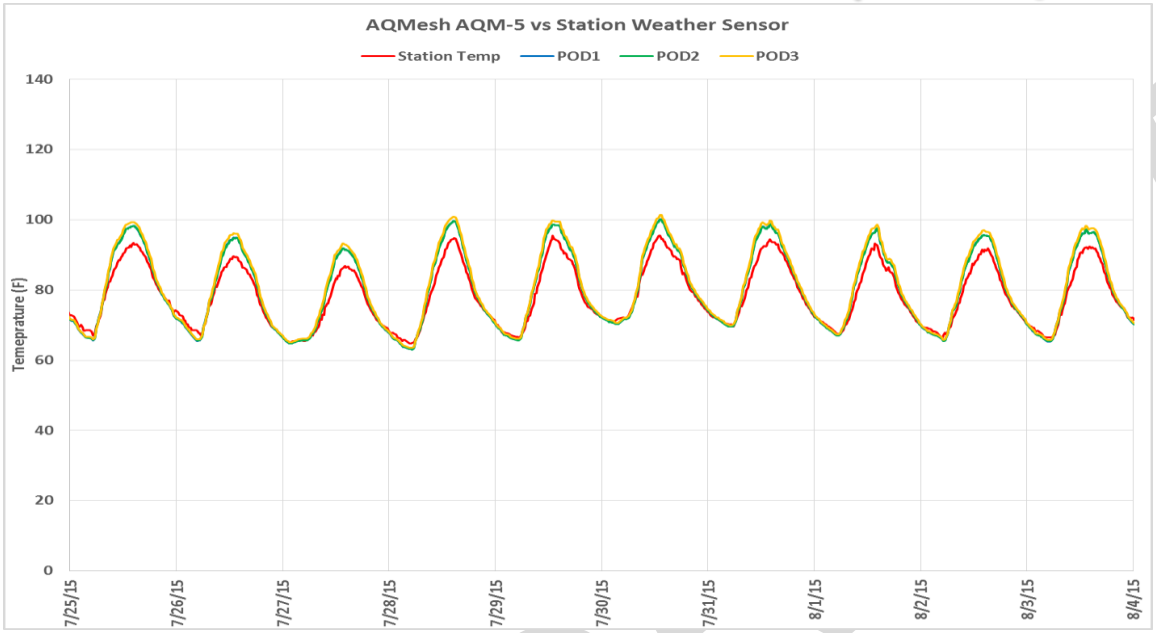
- AQMesh Ozone measurements show fair-to-good correlation with the corresponding FRM measurements ($0.46 < R^2 < 0.83$)
- AQMesh POD 2 largely overestimates FRM O_3 measurements



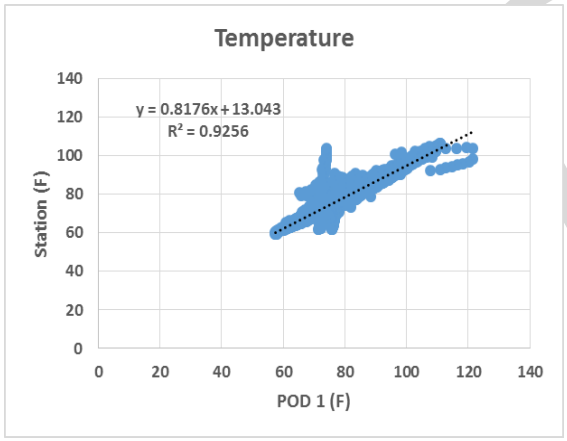


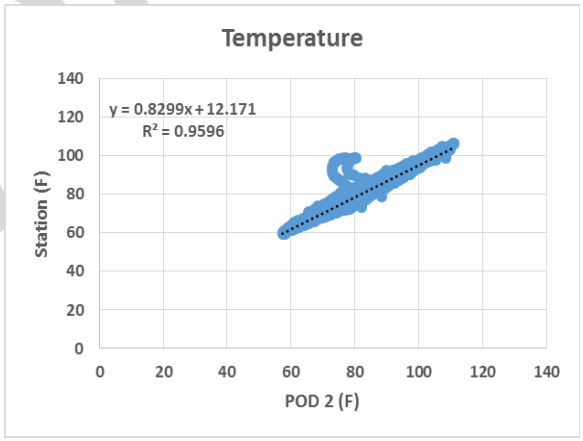


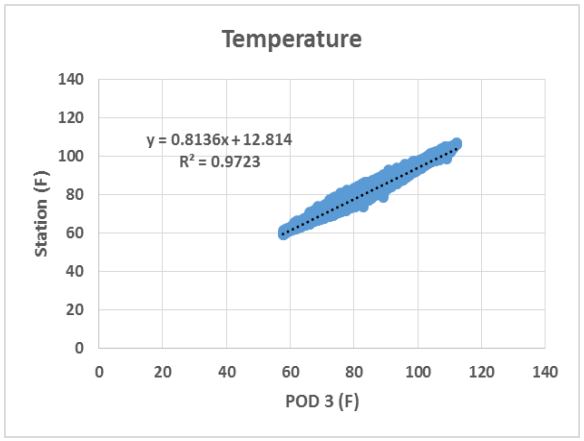
AQMesh vs FRM (Temp; 15-min ave)



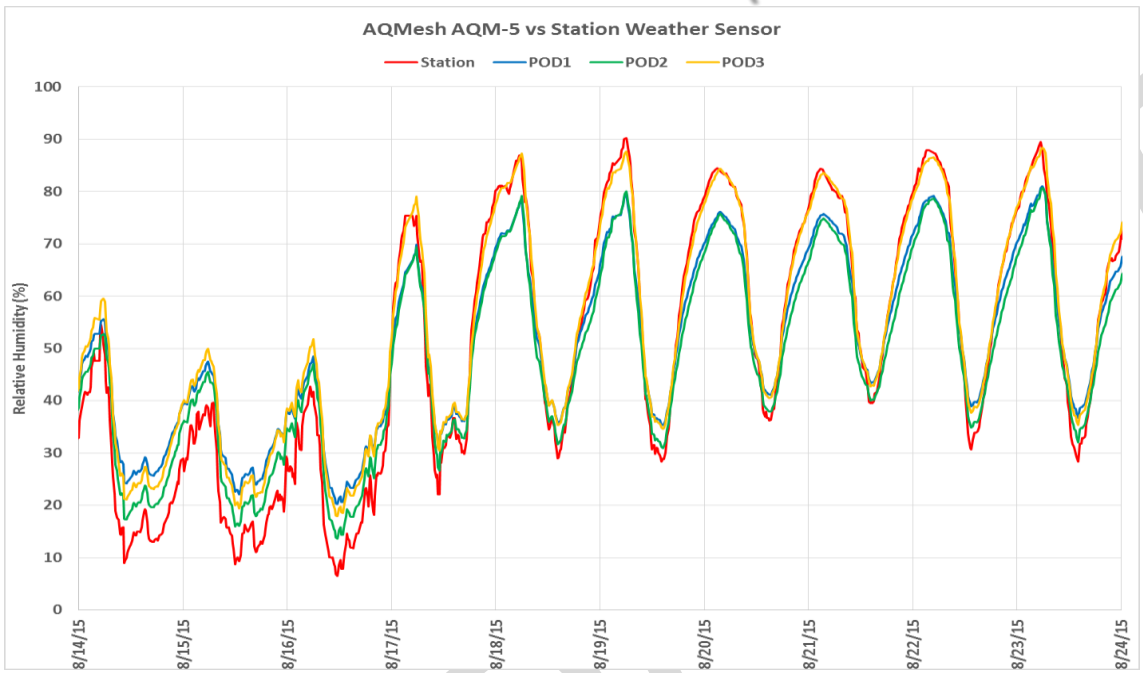
- AQMesh Temperature measurements are very well correlated with the corresponding FRM data ($0.93 < R^2 < 0.97$)



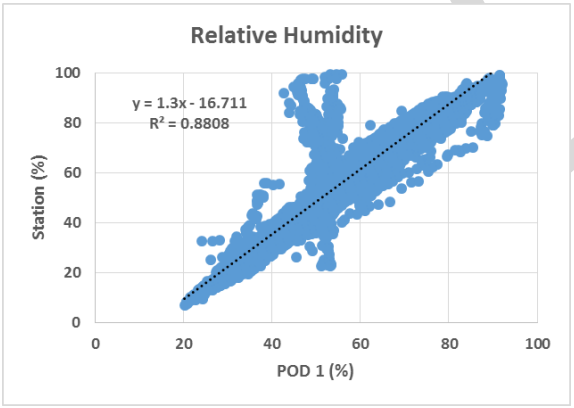


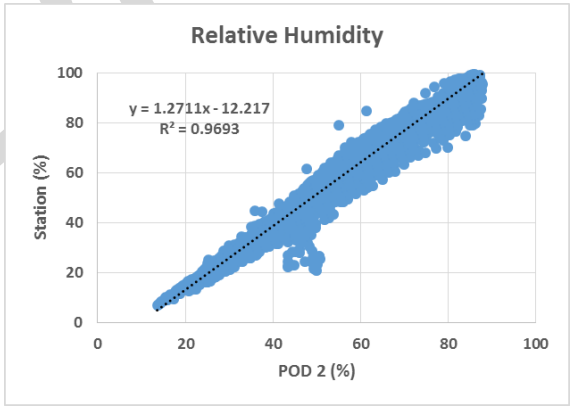


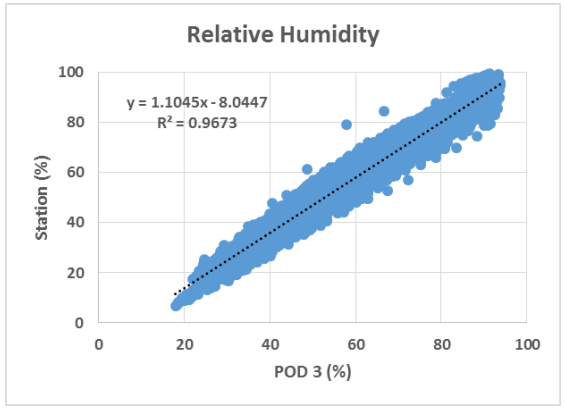
AQMesh vs FRM (Rel.Hum.; 15-min ave)



- AQMesh Relative Humidity measurements are very well correlated with the corresponding FRM data ($0.88 < R^2 < 0.97$)







Discussion

- Overall, the three AQMesh v.4.0 PODs showed substantial intra-model variability for all measured pollutants. Very low POD measurement variation was observed for T and RH
- Unlike for O3 and CO, the NO and NO2 measurements taken with the AQMesh v.4.0 sensors correlated poorly with the corresponding FRM data
  - O3: $0.46 < R^2 < 0.83$
  - CO: $0.42 < R^2 < 0.80$
  - NO: $R^2 \sim 0.0$ (POD 1 and POD 3); $R^2 = 0.44$ (POD 2)
  - NO2: $R2 < 0.1$ (POD 1 and POD 3); $R^2 = 0.46$ (POD 2)
- It should be noted that no sensor calibration was performed prior to the beginning of this field testing
- Field test results for the first version (v.3.0) of the AQMesh air quality sensor can be found on the AQ-SPEC website (www.aqmd.gov/aq-spec).
- Laboratory chamber testing is necessary to fully evaluate the performance of these sensors under controlled T and RH conditions and known gaseous concentrations.

- All results are still preliminary